EFFECTIVENESS OF FINE MESH SCREENING A HOLDING TANK IN RETAINING LARVAL AND JUVENILE FISH AT THE TRACY FISH COLLECTION FACILITY

Investigators

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Summary

The Central Valley Project's Tracy Fish Collection Facility (TFCF), located upstream of the Jones Pumping Plant (JPP) in the southern portion of the Sacramento-San Joaquin Delta (Delta), is responsible for collecting fish (salvage) and transporting them downstream away from the influence of the pumps. Fish that enter the TFCF have to go through a series of louvers and bypasses before being concentrated into a holding tank. The stainless steel holding tank screen (average square opening of 2.7 mm and an average diagonal opening of 3.8 mm) retains the fish in the tanks during collection; however, small fish, including the larval life-stage of threatened and endangered species such as delta smelt (*Hypomesus transpacificus*), can pass through a screen of this mesh size as was demonstrated by Sutphin *et al.* (2007) and Wu (2008).

The current holding tank mesh size was selected in the early 1950s as it was the smallest screen size shown to operate successfully most of the year and not clog with peat fibers (USBR 1956). This still holds true today, and the holding tank screen only clogs a few days per year.

The early designers did not consider changing the mesh size on the holding tanks to meet the conditions of the debris load in the water, as this was too expensive and labor intensive. With the invention of light weight, flexible, Nitex screen it is now possible to change the mesh size of the holding tanks quickly and inexpensively. Short term pilot studies were completed that looked at the possibility of wrapping a fine mesh, flexible screen around the existing holding tanks screen in spring when debris loads are at their lowest levels and when larval fish are present . In 2000 and 2008, a 1 mm and 0.5 mm mesh screens were used respectively. Both net sizes were able to fish for 24 hrs without clogging. The goal of this study was to determine if the Nitex screen is durable enough to be incorporated into the normal salvage operations at the TFCF and if this material will result in a greater number of living larval and juvenile fish being loaded into the fish-haul truck for release back to the Delta.

Problem Statement

Larval and juvenile fish are lost through the holding tank screen during fish salvage collections. A temporary blanket of 0.5 mm Nitex screen over the existing holding tank screen has shown promise for short term use. Successful Nitex screen retention of larval and juvenile fishes will mean enhanced salvage and more fishes released to the Delta. Application of the Nitex screen will be most valuable when delta smelt and longfin smelt (*Spirinchus thaleichthys*) larvae are present in the system. The purpose of this project is to not only verify increased catch but also to verify that these small fish are staying alive in the holding tanks.

Goals and Hypotheses

Goals:

1. Determine if the density of swimming larvae in the haul-out bucket is significantly different between the holding tanks with and without the Nitex screen.

2. Determine how long a 500 μm Nitex screen can be used in a holding tank before it fails (*i.e.*, rips, clogs, rolls down)

Null Hypotheses:

1. The holding tank with Nitex screen will not affect the density of swimming larvae.

2. The properly installed and durable Nitex screen can be left in a holding tank indefinitely.

Materials and Methods

Nitex screen, purchased for $700, was wrapped around the 2.4 m diameter holding tank screen up to a depth of 2.4 m and the ends were overlapped so that water flow impinged the Nitex screen against the holding tank screen. Three ropes encircled the screen and were attached with bungee cords on the top, middle and bottom of the screen. A ladder was used to secure the rope along the top of the screen. Installation or removal of the screen required less than 20 minutes of work once the tank was empty and locked out. In addition to the Nitex screen around the holding tank, Nitex screen was also installed on the haul-out bucket, which has 2.5 mm perforated holes.

At the conclusion of each sample period, both holding tanks were drained simultaneously by an operator in preparation for removing the fish to the haul-out truck. The sampler documented the type (peat, woody, Egeria) and approximate amount of debris (low, average, or heavy) in the sample. The tank that was sampled first each day alternated. The sampler took fish density samples from the 1703-L haul-out bucket once lifted up to waist level. Three 18.9-L black buckets were used to take a subsample of the swimming larvae/juveniles in the haul-out bucket. This was completed by quickly submerging the entire bucket and removing it quickly. Dead larvae inside the haul-out bucket sank to the bottom and did not contaminate the sample. Sampler observed swimming larval and juvenile fish in the three subsamples before they were euthanized.

After the paired sampling period, the Nitex screen was used for longer duration testing. The purpose was to see if the material can withstand continual use. The Nitex screen was installed on holding tank #3 and operated and cleaned under normal operating conditions. The water flow through the screen, tank depth, debris types entering the tanks (peat, wood, or Egeria), and screen differential were monitored daily until screen failure (clogged or ripped). A clogged screen was defined as a clearly visible differential (~ 100 mm) over the face of the screen. Once the screen was clogged, it was cleaned off with the high pressure utility hose and then put back into operation. Once a screen has been shown to clog, it was washed down and bleached (5% sodium hypochlorite for 10 minutes) and air dried to kill the biofouling microorganisms. The cleaning of the Nitex screen was best done in place. The purpose of continually using the Nitex screen was to see how long it lasted when used in production mode and if the cleaning process restored it back to the original condition. As water temperature in the Delta warmed up, we expected the rate of biofouling to increase.

Data Analysis and Interpretation

Statistical tests for paired sampling procedures were used to evaluate the samples. The number of swimming fish from the haul-out buckets was used to assess the effectiveness of two treatments (Nitex screen vs. no screen). Fish that were

collected more efficiently by the Nitex screen, but consequently killed while being held in the holding tank, sank to the bottom of the haul-out bucket and did not interfere with the measurement.

The flow rates passing through the two tanks were kept nearly equivalent. No paired samples were discarded due to a difference in total measured flow between the two tanks.

Paired samples were collected from April 1 to June 10, 2009. Data was analyzed in 2012. A draft report is in its initial stages and peer review and publication are planned for 2013.

Coordination and Collaboration

The study was coordinated with the TFCF biology staff, TFCF Fish Diversion Crew (Joel Imai), and TFCF management (Ron Silva). René Reyes was the PI for this project and directed the activities. René coordinated with the onsite operators, wrote a job hazard analysis, and obtained permits for this work. Brent Bridges and Brandon Wu assisted with screen installation, cleaning, and purchasing. Zak Sutphin analyzed the data, and assisted in writing the report. This project cannot be completed unless the operators were willing to help collect the samples and fix/remove the net in the event that it failed. In addition, this project could not have been completed unless the flow meters were working for both tanks 3 and 4.

Endangered Species Concerns

The sampling program for this project coincided with the larval/juvenile delta smelt season and therefore we potentially could have taken many of these fish. The intention of this project was to find a way to improve the salvage operations for delta smelt larvae/juveniles so that more of them are released back to the Delta. In addition, during our sampling, we were likely to take winter run salmon (*Oncorhynchus tshawytscha*). California Department of Fish and Game (CDFG), and National Marine Fisheries Service were given a copy of our proposal for consideration. The biological opinion written by the U.S. Fish and Wildlife Service already granted us permission for completing this type of study to help increase the salvage operations. Any ESA listed species collected from the 18.9-L bucket samples were measured and counted. Adult delta smelt or juvenile salmon collected in the sample were returned back to the Delta. All larval/juvenile delta smelt in the 18.9-L sample were preserved. Take for this project was reported daily to CDFG and take consisted of fish collected in our 18.9-L sample and not in the entire holding tank. We anticipated that with ten paired samples it was possible to capture up to 10,000 larval/juvenile delta smelt.

Dissemination of Results (Deliverables and Outcomes)

The primary deliverable will be an article published in the Tracy Series Technical Report. Updates will be provided at TTAT meetings.

Literature Cited

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